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Taxonomic notes on *Borgmeiermyia* Townsend (Diptera, Tachinidae) with the first host record for the genus

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Abstract

Borgmeiermyia Townsend, 1935 is a small Neotropical genus of Tachinidae (Diptera) with four described species. Brief descriptions are given to the previously unknown females of *B. brasiliana* Townsend, 1935 and *B. paraguayana* Sehnal, 1998, and the male of *B. peruana* Arnaud, 1963. An identification key to the four known species is given, as well as comments on characters with intraspecific variation. Change of depository of the holotype of *B. brasiliana* from one institution to another is discussed and its current location is given. Also, the first host is recorded for the genus with the occurrence of *B. paraguayana* parasitizing *Phylloptera* aff. *ovalifolia* Burmeister, 1839 (Orthoptera: Tettigoniidae: Phaneropterinae).

Keywords

multifissicorn antenna, taxonomy, *Phylloptera*, host record, Neotropical region

Introduction

Borgmeiermyia Townsend, 1935 is a South American tachinid genus with four known species. The males of *Borgmeiermyia* species are typically characterized by remarkable multifissicorn antennae, also present in a few other Neotropical genera (e.g. *Talarocera* Williston, *Cryptocladocera* Bezzi, *Ucayalimyia* Townsend).

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The genus was described by Townsend (1935) to include a single new species *B. brasiliana* Townsend from Rio de Janeiro, based on one male specimen collected by Father Borgmeier (see comments below). Arnaud (1963) studied a further 15 specimens of this genus, redescribed the male of *B. brasiliana* and described two new species: *B. rozeni* Arnaud from Nova Teutônia, Brazil (both sexes described), and *B. peruana* Arnaud from Tingo Maria, Peru (a single female described). Sehnal (1998) described the new species *B. paraguayana* Sehnal from San Bernardino, Paraguay (based on two males).

The multifissicorn first flagellomere of the males is an extremely conspicuous feature, and this has contributed to the uncertainty about the systematic placement of this genus. Townsend (1935) placed the genus in the tribe Frontinini; Arnaud (1963) suggested the placement was not correct but did not propose any reassignment; whereas, in the Neotropical catalogue, Guimarães (1971) treated the genus within the Siphonini. We have not assigned any systematic discussion about the tribal placement of the genus.

Arnaud (1963) stated that the hosts of this genus of parasitoid flies were unknown, but suggested they could be Lepidoptera. However, we record the first host of a *Borgmeiermyia* species as a tettigoniid grasshopper (*Phylloptera* aff. *ovalifolia* Burmeister (Orthoptera, Tettigoniidae, Phaneropterinae)) parasitized by specimens of *B. paraguayana*.

In the present study, the available material enables us to describe for the first time the females of *B. brasiliana* and *B. paraguayana*, and the male of *B. peruana*. Also, an identification key to the species is given. Some examined characters showed intraspecific variation and we present a brief discussion on their reliability and usefulness for diagnosing and separating the species.

Material and methods

The material examined is deposited in the Instituto Alexander von Humboldt, Bogotá, Colombia (IAVH), Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA), Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ), Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (MZSP), and The Natural History Museum, London, United Kingdom (BMNH).

The morphological terminology used follows Mcalpine (1981) and Wood (1987). There is an important note to be made here about the terms usually applied for the scutellar setae of *Borgmeiermyia* species. Arnaud (1963) recognized "four lateral scutellar bristles" and one "apical" pair, and within the lateral pairs he distinguished about one "subapical lateral" and one "apical lateral" pairs. Sehnal (1998) recognized "basal", "lateral", "subapical" and "apical" scutellar setae. His "subapical" is equivalent to the "subapical lateral" of Arnaud (1963), and his "apical" is the "apical lateral" of Arnaud. Sehnal (1998) did not recognise the apical setae. The apical setae is indeed present, but sometimes it is undeveloped or it may be weakly developed so that one can overlook it easily. Herein, we recognized the following scutellar setae: one pair of basal, three

pairs of lateral, one pair of apical and one pair of discal (there is no disagreement about the recognition and terminology of this latter). The three lateral scutellar pairs are termed here: anterior, median and posterior lateral scutellar setae. The median lateral is equivalent to the "subapical lateral" of Arnaud (1963), and the posterior lateral is his "apical lateral".

Systematics

Borgmeiermyia Townsend, 1935

Borgmeiermyia Townsend 1935: 292 (genus description, description of type species, key to multifissicorn genera), type species: *Borgmeiermyia brasiliana* Townsend, by original designation.

Borgmeiermyia: Townsend 1936: 168 (key to Frontinini genera); Townsend 1940: 315 (generic diagnosis); Arnaud 1963: 2 (genus revision, description of *B. rozeni* and *B. peruana*, identification key); Guimarães 1971: 166 (cat., Siphonini); O'Hara 1989: 16 (comments); Sehnal 1998: 349 (description of *B. paraguayana*).

Diagnosis. Small flies, from 4 to 5.5 mm. Colour blackish, with golden and silvery pruinosity. Head: fronto-orbital plate, parafacialia and gena usually golden pruinose; eye with extremely fine, short, sparse hairs (considered bare); male flagellomere multifissicorn, split into about 20 pubescent rami on inner and outer sides of a median rib; female flagellomere elongate and non-ramate; one or two pairs of proclinate fronto-orbital setae and one pair of reclinate fronto-orbital setae; facial ridge with erect supravibrissal setae, increasing in length and thickness from above to below, not reaching aristal base. Thorax: mesonotum black in ground colour with golden pruinosity; pleural areas brown to dark-brown with golden pruinosity above and silvery to golden pruinose bellow; scutellum with one pair of basal, three pairs of lateral, one pair of apical and one pair of discal setae; apical scutellar setae much shorter than posterior lateral setae; wing with R1 dorsally setulose, R_{4+5} dorsally setulose from base to half-way or beyond r-m crossvein. Abdomen: black with narrow silvery to golden pruinose bands on tergites 3, 4 and 5; tergites 1+2, 3 and 4 with lateral marginal setae; tergites 2, 3, 4 and 5 with 2 or 3 hairlike marginal setae.

Discussion. The systematic position of this genus is uncertain. It was placed within the siphonines by Guimarães (1971) and shares the following features with members of this tribe: wing with R_{4+5} dorsally setulose and posterior lateral scutellar setae convergent. Some few siphonine taxa present a modification on male first flagellomere under three diverse conditions: bilobed, trilobed or pectinate (=multifissicorn) (O'Hara 1989). The pectinate condition is also very rare among the siphonines, shared by *Borgmeiermyia* and some species of *Peribaea* Robineau-Desvoidy. *Borgmeiermyia* can also be distinguished from other siphonines by the presence of three pairs of lateral scutellar setae.

Key to species of *Borgmeiermyia*

1. Median lateral scutellar setae long, at least 2/3 length of posterior lateral scutellar setae **2**
– Median lateral scutellar setae short, about one-half length of posterior lateral scutellar setae (sometimes slightly longer than one-half) **3**
2. Male cercus and surstylus broad and cercus strongly curved dorsally at mid length in lateral view and with apex rounded (Figure 2) (Colombia, Peru, Brazil) ..... ***peruana***
– Male cercus and surstylus less broad (not as above) and cercus slightly curved dorsally in lateral view and with apex truncated (Brazil, Paraguay) ..... ***paraguayana***
3. Vein R_{4+5} setulose dorsally between half and the whole distance to r-m crossvein, but not beyond r-m; male with outer rami of flagellomere brown and the inner rami yellow; wing costal margin with a brown continuous macula from apex of Sc to apex of R_{2+3} (Figure 5) (Brazil) ..... ***brasiliana***
– Vein R_{4+5} setulose dorsally far beyond r-m crossvein; male with inner and outer rami of flagellomere brown; wing costal margin with a brown macula from apex of Sc to apex of R_{2+3} but this macula partially interrupted after apex of R_1 (Figure 7) (Brazil) ..... ***rozeni***

Remarks on the key and variable characters

This identification key was prepared based on the characters mentioned by Arnaud (1963), Sehnal (1998) and our examinations. Sehnal (1998) compared the length of the median lateral scutellar seta with scutellum length: longer than scutellum in *B. paraguayana* and shorter than scutellum in *B. brasiliana* and *B. rozeni*. However, this relative length is variable for *B. brasiliana* given that an examined female has the median lateral seta shorter than scutellum, whereas the male holotype (MNRJ) has the seta slightly longer than scutellum. On the other hand, the relative length of the median and posterior lateral scutellar setae, as used by Arnaud (1963), proved to be a more reliable character to distinguish and recognize the species of *Borgmeiermyia*.

The dorsal setulosity of vein R_{4+5} has been used to recognize and distinguish between *B. peruana* and *B. paraguayana* (Sehnal 1998), and other species (Arnaud 1963). Arnaud (1963) described this character for *B. peruana* as "R_5 above bristled to R_6, with one bristle beyond and removed from R_6"; whereas Sehnal (1998) described *B. paraguayana* as having "R_{4+5} dorsally bristled over little more than half distance to r-m". This character proved to be intraspecifically variable and not reliable for diagnostic purposes, at least for these two resembling species. We found specimens of *B. peruana* that fitted the original description, although other specimens had R_{4+5} setulose either over three-fourths of the distance to r-m crossvein or the whole distance to r-m. With *B. paraguayana*, we also observed some variation but to a lesser degree: specimens whose setulosity fits the original description, and others with the setulae almost reach-

ing r-m. Variation was also observed in the holotype of *B. brasiliana* examined here (setulose to r-m crossvein) and a male examined by Arnaud (1963) ("R_5 above bristled only one-half of distance to R_6"). Although intraspecific variation has been found in *B. brasiliana*, this character is diagnostic and useful for separating *B. brasiliana* and *B. rozeni*, as the latter is the only species with the setulosity extending far beyond the r-m crossvein.

Borgmeiermyia brasiliana **Townsend, 1935**

Fig. 5

Borgmeiermyia brasiliana Townsend 1935: 293, Figs 1–2 (male description), holotype male (Museu Nacional, Rio de Janeiro; formerly at "Instituto de Biologia Vegetal, Rio de Janeiro"; see comments on type depository below), type locality: Brazil, Rio de Janeiro, Jardim Botânico [22°58'03"S, 43°13'28"W].

Borgmeiermyia brasiliana; Townsend 1940: 315 (redescription, type data); Arnaud 1963: 5, Figs 5, 8, 12–14 (male redescription, key); Guimarães 1971: 166 (cat.); Sehnal 1998: 353 (comments).

Type material examined: Holotype male (MNRJ) labelled as follows "HOLOTYPUS" (red label); "Borgmeiermyia / brasiliana TT / Holotype ♂ / Det CHTT"; "Rio de Janeiro / Jard. Botanico / 7–934 / H. Souza Lopes [sic]"; "EMBRAPA" (pink label), in excellent condition. See comments on type collector below.

Other material examined: BRAZIL, *State of Rio de Janeiro*, Itatiaia, 1 female, no date, J.F. Zikán leg. (MZSP).

Description of female. Body length: 5.4 mm (n=1), wing length: 4.1 mm (n=1). Differs from the male redescription provided by Arnaud (1963) by the following: Frons at vertex level about 0.35 of head width; frons at most four times width of parafrons (at narrowest point, beside ocellar triangle); parafacialia narrowing slightly below (not strongly as male); antenna not multifissicorn and yellow, but brown at extreme base and apical fourth of arista and posterior portion of flagellomere; flagellomere elongate, reaching level of vibrissa; gena about one-sixth of eye height. Length of median lateral scutellar seta about 1/2 or slightly longer than 1/2 of the posterior lateral scutellar seta (the male holotype between 1/2 and 3/5). Both female specimen and the male holotype have R_{4+5} setulose dorsally on the whole distance to the r-m crossvein, although the male of Santa Catarina (examined by Arnaud, 1963) was characterized as setulose at only half the distance to r-m.

Comments: Male described by Townsend (1935), with head illustration (Figs 1–2); and later redescribed and richly illustrated by Arnaud (1963). His redescription, based on one male from Santa Catarina, was compared with the male holotype (MNRJ) and confirmed. Also, the female described herein was compared with the holotype. This species can be distinguished from *B. paraguayana* and *B. peruana* by the median lateral scutellar seta short, about one-half length of posterior lateral scutellar setae (sometimes slightly longer than one-half but not about or over 2/3) and from *B.*

rozeni by the vein R_{4+5} setulose dorsally between half and the whole distance to r-m crossvein, not beyond r-m, and by the color of male flagellomere.

Type depository and type collector: The holotype male was originally deposited in the "Instituto de Biologia Vegetal" (Rio de Janeiro) (Townsend 1935: 293), but this institution was closed in 1938 by a federal order and the "Centro Nacional de Estudos e Pesquisas Agronômicas" was then created. This latter was the primordial agency which became what is now EMBRAPA. Consequently, the holotype of *B. brasiliana* passed from one institution to another until the middle of the 20th century when it was donated by EMBRAPA to the Museu Nacional (MNRJ) wherein it is now securely deposited. The holotype collector in the label is not correct. The type was collected by Father Borgmeier as mentioned by Townsend (1935: 293) in the original description and by Arnaud (1963: 10) who exchanged correspondence with Father Borgmeier about some interesting facts on *B. brasiliana* as illustrated here "Father Borgmeier informed me (*in litt.*) that the holotype specimen of *B. brasiliana* was collected on the inside of a window in his former office in the Jardim Botanico." (Arnaud, 1963: 10).

Distribution: BRAZIL (Rio de Janeiro, Santa Catarina)

Borgmeiermyia paraguayana Sehnal, 1998

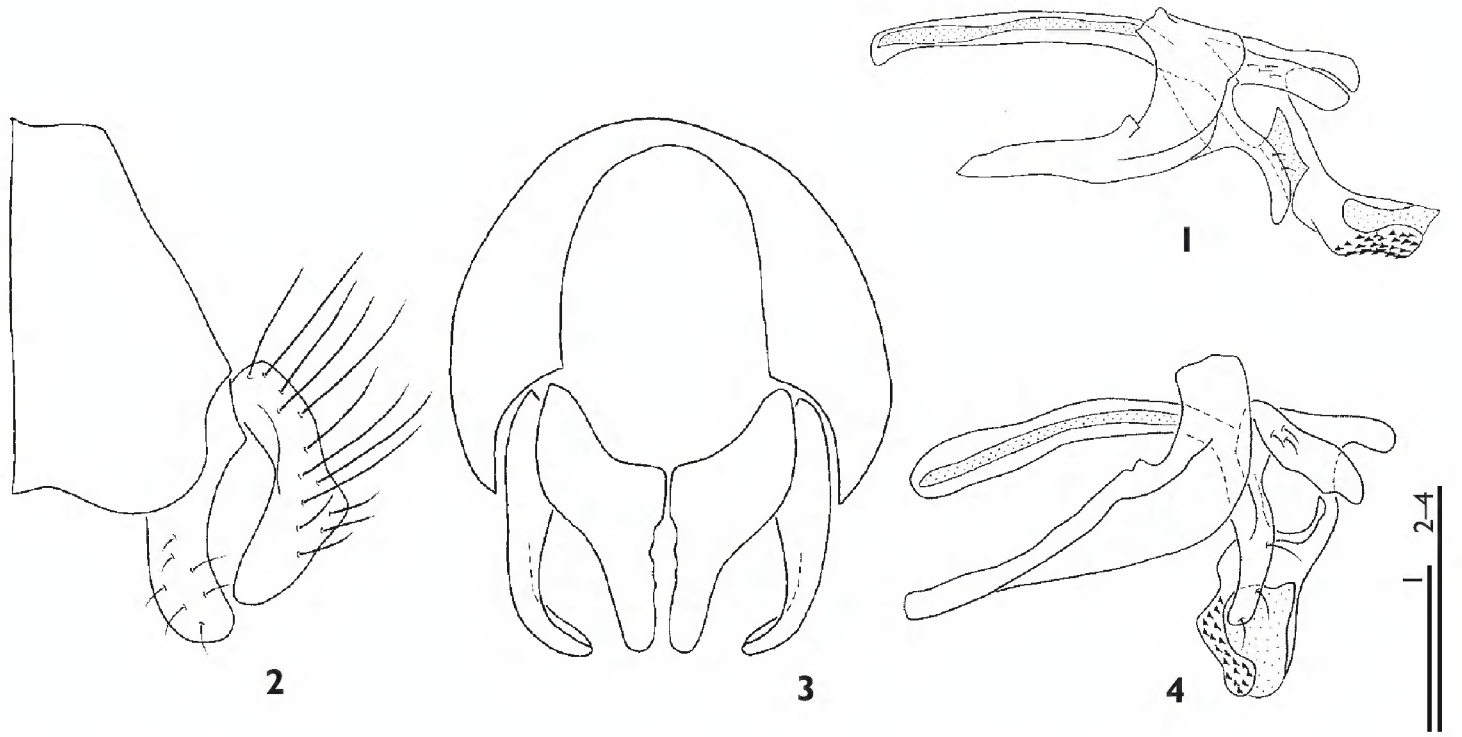
Figs 1, 6, 10

Borgmeiermyia paraguayana Sehnal 1998: 350, Figs 1–5(male description), holotype male (Naturhistorisches Museum Wien), type locality: Paraguay, San Bernardino [ca. 25°16'S, 57°19'W].

Material examined: BRAZIL, *State of São Paulo*, São Paulo, Ipiranga, 6 males and 1 female, xi.1998, C. [Carlos] Campaner leg. (MZSP) (one male dissected).

Description of female. Body length: 5.3 mm (n=1), wing length: 3.8 mm (n=1). Differs from the male description (Sehnal 1998) by its parafacial with silvery yellowish pruinosity below; the antenna yellow and not multifissicorn; the narrow band on the basal portion of tergites 3, 4 and 5 silvery yellowish pruinose. Length of median lateral scutellar seta between 2/3 and 3/4 length of posterior lateral scutellar seta.

Comments: The male was described by Sehnal (1998) with illustrations of habitus and right wing of the holotype, and the terminalia and sternite 5 of a paratype. The male aedeagus is illustrated in more detail here (Figure 1) based on a dissected male from southeastern Brazil. This species differs from *B. brasiliana* and *B. rozeni* by the median pair of lateral scutellar setae long, clearly longer than one-half length of posterior lateral scutellar setae and from *B. peruana* by the cerci curved not so strongly. The cerci of *B. paraguayana* differ from that of *B. brasiliana* by the apical portion of this structure broader (subtruncate) in the lateral view and by the median-posterior region no curved. As mentioned above, we found intraspecific variation in the dorsal setulosity of R_{4+5} (see comments on the Key to identification).



Figures 1–4. *Borgmeiermyia paraguayana*: **1** male aedeagus, lateral view (São Paulo); *B. peruana* **2** male terminalia, lateral view (Amazonas, Manaus) **3** male terminalia, dorsal view **4** male aedeagus, lateral view. (Scale bars = 0.25 mm).

Puparium. (Figure 10). Length: 4.9 mm (n=4), width: 2.1 mm. Medium-sized, moderately elongate, reddish-brown. Anal spiracular plates shiny black, close to each other, not prominent and clearly above midline of puparium. Each anal spiracular plate with four sinuate respiratory slits somewhat convergent with the median scar.

Host record: The specimens from São Paulo were reared by Carlos Campaner (Museu de Zoologia, São Paulo) from one adult tettigoniid. The host was identified as *Phylloptera* sp., probably *Phylloptera ovalifolia* Burmeister, 1839 (Orthoptera, Tettigoniidae, Phaneropterinae). This is the first host record known for *Borgmeiermyia*.

Distribution: BRAZIL (Sao Paulo) rec. n., PARAGUAY (San Bernardino)

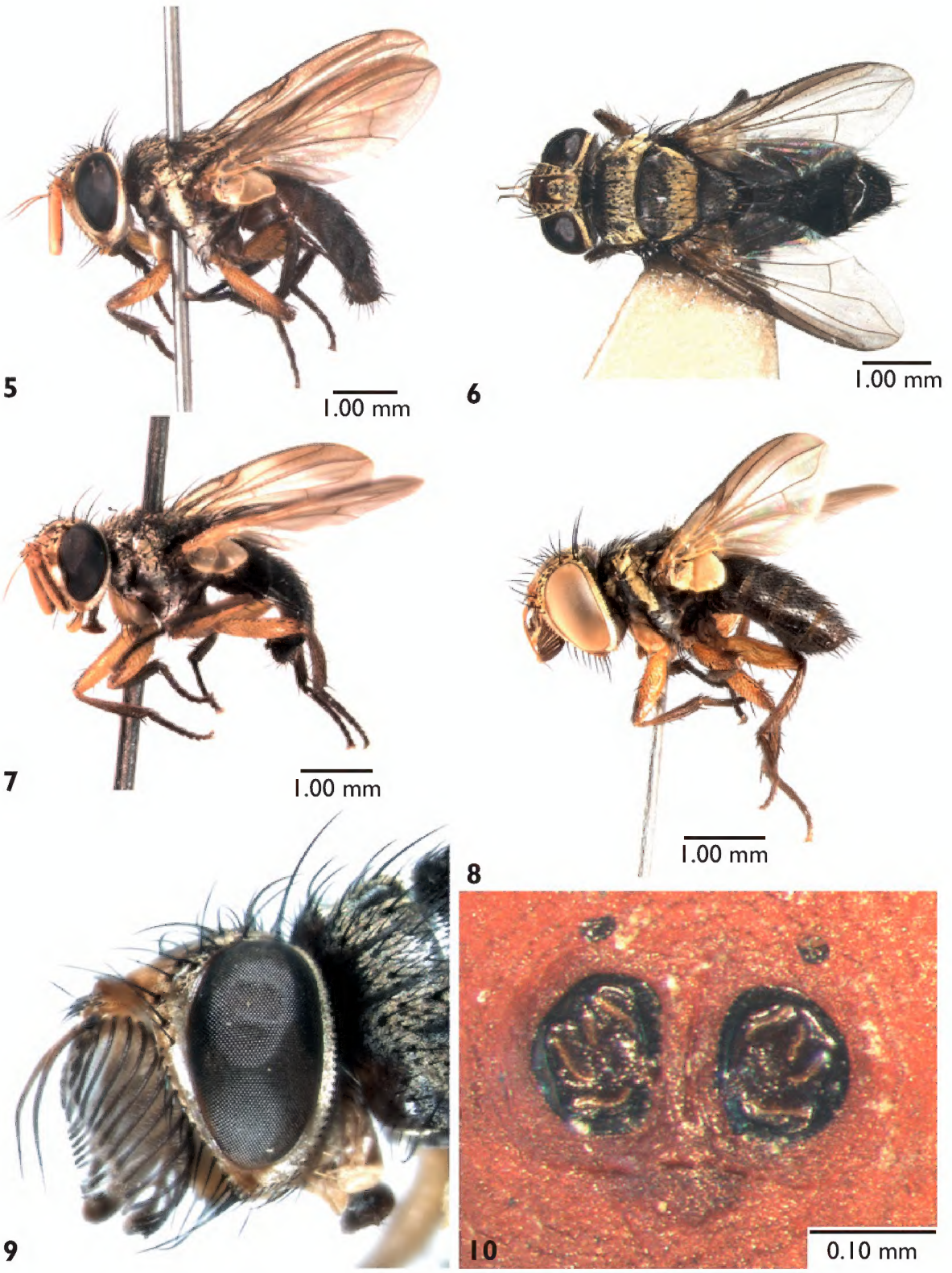
Borgmeiermyia peruana Arnaud, 1963

Figs 2–4, 8

Borgmeiermyia peruana Arnaud 1963: 10, fig. 11 (female description, key), holotype female (California Academy of Sciences), type locality: Peru, Tingo Maria, Monson Valley [ca. 09°17'S, 75°59'W].

Borgmeiermyia peruana; Guimarães 1971: 166 (cat.), Sehnal 1998: 354 (comments).

Material examined: COLOMBIA, *Dept. Putumayo*: P.N.N. La Paya, Cabaña Viviano, 0°7'S 74°56'W, 320m, 1 male, 26.IX–1.X.2001, R. Cobete leg. (IAVH) (terminalia dissected); "Putumayo", 1 female, X.1934, Apolinar Maria leg. (MZSP); BRAZIL, *State of Amazonas*, Manaus, J.A. Rafael leg., 04.XI.1978, 2 males (MZSP), VII.1979, 1 male (MZSP) (terminalia dissected); Manaus, C. Univers. [Cidade Universitária], malaise,



Figures 5–10. 5 *Borgmeiermyia brasiliana*, female, lateral habitus (Rio de Janeiro, Itatiaia) **6** *B. paraguayana*, female, dorsal habitus (São Paulo) **7** *B. rozeni*, female, lateral habitus (Santa Catarina, Nova Teutônia) **8** *B. peruana*, male, lateral habitus (Amazonas, Manaus) **9** *B. rozeni*, male paratype, head, lateral view (Santa Catarina, Nova Teutônia) **10** *B. paraguayana*, anal spiracles of puparium, posterior view.

J.A. Rafael leg., 1 male, 07.VI.1982 (INPA), 1 male, 24.VI.1982 (INPA); Manaus, F. Esteio, R. 1401, km 17, 1 male, 17–31.I.1996, malaise, L.E.F.R. Silva leg. (INPA).

Description of male. Body length: 4.25 mm (n=2), wing length: 3.0 mm (n=2). Differs from the female by the following: head with frons width at vertex 0.29 of head width; antenna with first flagellomere multifissicorn; antenna with scape, pedicel and inner rami of flagellomere yellow, and the extreme base of arista and the outer rami of flagellomere brown, arista brownish; gena about one-sixth of eye height; proboscis black-setulose on prementum and golden-setulose on labella. Length of median lateral

scutellar seta varying in length from slightly longer than 2/3 (specimens from Amazonas) to about 4/5 (specimen from Colombia) length of posterior lateral scutellar seta.

Terminalia (Figs 2–4): Very similar to those of *B. brasiliana* when compared with the illustration of terminalia given by Arnaud (1963), differing by the cerci and surstylus broader and the first strongly curved dorsally at midlength in lateral view. Surstylus in posterior view with basal halves broader.

Comments: Female described by Arnaud (1963), with the wing illustrated (fig. 11). The males herein described were compared with the female description given by Arnaud (1963). The illustrated terminalia was dissected from a male from Manaus (Amazonia, Brazil), and the photographed male is also from Manaus. The specimens examined here showed variation in the length of median lateral scutellar seta. The female holotype from Peru has the pair of median lateral scutellar setae "more than four-fifths of length of apical [posterior] lateral scutellar bristles" (Arnaud 1963), as well as the Colombian male and female here examined, but this length differs from that found in males from Amazonas, which have the median lateral scutellar seta slightly longer than 2/3 length of posterior lateral one.

Distribution: COLOMBIA (Putumayo) rec. n., PERU (Huánuco), BRAZIL (Amazonas) rec. n.

Borgmeiermyia rozeni Arnaud, 1963

Figs 7, 9

Borgmeiermyia rozeni Arnaud 1963: 12, Figs 1–4, 6–7, 9–10, 15–17 (male and female description, key), holotype male (American Museum of Natural History), type locality: Brazil, Santa Catarina, Nova Teutônia [ca. 27°09'S, 52°18'W].

Borgmeiermyia rozeni; Guimarães 1971: 166 (cat.); Sehnal 1998: 353 (comments).

Type material examined: one paratype male, BRAZIL, *State of Santa Catarina*, Nova Teutônia, 06.iii.1962, F. Plaumann leg. (MZSP); one paratype male, same locality and collector, 02.v.1959 (BMNH).

Additional material examined: same data as paratypes, but V.1967, 3 males and 2 females (MZSP), III.1971, 2 males (MZSP), IV.1971, 4 males (MZSP), 28.IV.1938, 1 female (BMNH), 01.III.1938, 1 female (BMNH); *State of Amazonas*, Manaus, 04.XI.1978, 5 males, J.A. Rafael leg. (MZSP) (one male with the terminalia dissected).

Comments: Both male and female described and richly illustrated by Arnaud (1963). Here we present the lateral habitus of a female from Nova Teutônia (Figure 7) and, for detailed observation, the head of the male paratype in profile (Figure 9). The geographical distribution of *B. rozeni* has been extended northwards with the recognition of 5 male specimens from Manaus (Amazonas). The identification of these specimens was confirmed by comparing the terminalia of a dissected male with the figures of the male terminalia of *B. rozeni* in Arnaud (1963).

Distribution: BRAZIL (Amazonas rec. n., Santa Catarina).

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